

REMARKS

The Examiner is thanked for his Office Action.

The claims presently outstanding are Claims 1-3. New Claims 4-7 are sought to be added. These claims are closely based on the summary paragraphs in pages 6-7 of the application as filed, and are believed not to introduce new matter, and their entry is respectfully requested.

The Examiner is thanked for noting the informality on page 5, which is now sought to be removed.

Art Rejections

All claims have been rejected over Peddada. The art rejections are all respectfully traversed.

Some of the major technical differences between the references applied and the disclosure of the present application will now be reviewed.

Of course, these points in the specification do not define the scope or interpretation of any of the claims; they are listed merely to help appreciate the importance of the claim distinctions which will be reviewed thereafter.

Peddada *et al.* suggests texture caching, but does not appear to provide any suggestion of letting the graphics accelerator itself access main memory directly. To the contrary, Peddada *et al.* appears to center on graphics drivers (i.e. low-level system-side software), rather than processes running on the graphics accelerator itself:

Col.3 ll.61¹: (Summary of the Invention): "A graphics driver for an ... AGP personal computer has a set-render process that is called by a high-level application when a texture is ready for rendering.... A handle-texture process is called... before the 3D graphics engine is enabled to render the texture."

The Examiner has suggested that Peddada provides for transfer into

texture cache, but this does not meet the limitations of the claims. Peddada does not appear to have anything to do with virtual memory.

Virtual Texture Memory

Following are some paragraphs from the application as filed, which may help in interpreting Peddada:

One of the basic tools of computer architecture is "virtual" memory. This is a technique which allows application software to use a very large range of memory addresses, without knowing how much physical memory is actually present on the computer, nor how the virtual addresses correspond to the physical addresses which are actually used to address the physical memory chips (or other memory devices) over a bus.

...

Virtualization of texture memory, like virtualization of host memory, gives the user the impression of a memory space which is larger than can be physically accommodated in real memory. ...

...

The present inventor has realized that managing the texture memory in the driver or by the application is very difficult (or impossible) to do properly, because:

1. What does the driver/application do when it runs out of memory and needs to fit another texture in? Which texture(s) does it delete?
2. The texture has to be completely resident and physically contiguous so a large enough space must be made available.
3. A texture which is about to be used MUST NOT be deleted or moved: otherwise all command buffers will be outdated.
4. In some cases a texture map will not fit into memory even when all other textures are deleted (a 2Kx2K 32bpp texture map takes 16MBytes of memory).
5. The texture heap must be compacted to reclaim storage.

Note that the present application does not purport to be the first to suggest virtual texture memory. As also noted in the application as filed:

The idea of applying virtual management techniques to textures in 3D graphics hardware appears to be suggested, for example, by U.S. Patent 5,790,130 to Gannett. This patent suggests that "A graphics hardware device, coupled to the host computer, renders texture mapped images, and includes a local memory that stores at least a portion of the texture data stored in the system memory at any one time. A software daemon runs on the processor of the host computer and manages transferring texture data from the system memory to the local memory when needed by the hardware device to render an image." (Abstract)

Looking at Peddada in view of this background, it can be seen that Peddada DOES NOT HAVE ANYTHING TO DO WITH VIRTUAL MEMORY MANAGEMENT. It is not correct that Peddada shows "page faulting," and indeed Peddada does not appear to refer anywhere to "virtual" memory nor to "page fault" nor "page faulting." Peddada does discuss texture caching, but this is not the same.

If the undersigned attorney has overlooked a relevant teaching in any of the references, the Examiner is requested to point out very specifically where such teaching may be found.

Motivation to Modify

Furthermore, even if all of the claimed elements were present in one or another of the references, the Examiner has not shown that these references could properly be combined and/or modified to meet the claim limitations.¹

Claim Distinctions

Some features of the claims are noted as follows for the Examiner's convenience, but of course these notes do not dictate the interpretation of the claim, nor indicate that some features are more important than others.

No reference relied on is seen to teach or suggest the claimed feature of "page faulting" as recited, with other limitations, in the context of Claim 1.

Even more clearly, the references relied on cannot possibly suggest the claimed feature of: "page faulting of texture data invisibly to the host processor" as recited, with other limitations, in the context of Claim 1.

¹"When prior art references require selective combination ... to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gained from the invention itself.... Something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination." *Uniroyal, Inc. v. Rudkin-Wiley Corp.*, 5 USPQ2d 1434, 1438 (Fed.Cir. 1988), quoting *Interconnect Planning Corp. v. Feil*, 227 USPQ 543 (Fed.Cir. 1985), and *Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick*, 221 USPQ 481 (Fed.Cir. 1984). "While [a reference] may be capable of being modified to run the way [the applicant's] apparatus is claimed, there must be a suggestion or motivation in the reference to do so. See *In re Gordon*, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984) ("The mere fact that the prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification."). *In re Mills*, 916 F.2d 680, 16 U.S.P.Q.2d 1430 (Fed.Cir. 1990).

None of the references relied on are seen to teach or suggest the claimed feature of "page faulting" as recited, with other limitations, in the context of Claim 2.

Even more clearly, the references relied on cannot possibly suggest the claimed feature of: "page faulting of texture data... invisibly to the host processor" as recited, with other limitations, in the context of Claim 2.

More clearly yet, the reference relied on cannot possibly suggest the claimed feature of: "page faulting of texture data... invisibly to the host processor, except when said graphics accelerator unit calls for data which has not recently been present in said main memory" as recited, with other limitations, in the context of Claim 2.

No reference relied on is seen to teach or suggest the claimed feature of "page faulting" as recited, with other limitations, in the context of Claim 3.

No reference relied on is seen to teach or suggest the claimed feature of "page faulting" as recited, with other limitations, in the context of Claim 3.

More clearly yet, the reference relied on cannot possibly suggest the claimed feature of: "page faulting of said texture data, invisibly to said CPU" as recited, with other limitations, in the context of Claim 3.

No reference relied on is even seen to suggest the claimed combination of "first memory management logic" with "a graphics accelerator unit, comprising ... a second memory management unit," much less this combination wherein the second memory management unit "performs page faulting of said texture data, invisibly to said CPU", as recited in Claim 3.

Added Claims

The newly presented claims are also respectfully submitted to be patentable, for very similar reasons. The Examiner's attention is particularly directed to the last paragraph of Claim 5, and to the last two

paragraphs of Claim 7.

Support:

As noted above, the added claims are closely base on the Summary paragraphs of the application as filed. For example, Claim 4 is closely based on the Summary paragraph which starts at line 11 of page 8.

Conclusion

Thus, all grounds of rejection and/or objection are traversed or accommodated, and favorable reconsideration and allowance are respectfully requested. The Examiner is requested to telephone the undersigned attorney for an interview to resolve any remaining issues.

Respectfully submitted,

A handwritten signature in black ink, appearing to be 'R. Groover', with a long horizontal flourish extending to the right.

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